

ALASKA SAR PROCESSOR IMPLEMENTATION FOR JERS -1
(Submitted to Image Processing and Registration session)

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Abstract

The National Space Development Agency of Japan (NASDA) launched its Earth Resources Satellite-1 (JERS-1) in January 1992, to globally map the ocean, ice, and land resources. JERS-1 carries several instruments one of which is the Synthetic Aperture Radar (SAR). The ground station at the Alaska SAR Facility (ASF) in Fairbanks, Alaska receives, processes, archives, and distributes this SAR data in addition to the SAR data from the European Space Agency's first Remote-Sensing Satellite (ERS-1). This paper examines the algorithms used for JERS-1 data processing which are in some ways similar to those used for ERS-1.

In order to keep up with the high data rate of SAR instruments, the SPS contains at its processing core the Alaska SAR Processor (ASP) which is a custom-built pipeline digital computer developed at the Jet Propulsion Laboratory. To meet the JERS-1 data requirements, the ASP hardware structure includes a new board (JDFM) which decodes and saves the house keeping (HK) data as well as the pulse code modulation (PCM) data. It also maps the 31/3Q raw input data together with the sensitivity time control (STC) and automatic gain control (AGC) values to the 81/8Q format before input to the ASP pipeline.

To minimize tape interface time for raw data input at every image region, the JERS-1 pre-processing, and main processing are implemented in a "two pass" manner. During each pass, after initializing the input tape drive at the proper starting address, pre-processing and processing are performed alternatively such that during first pass all odd numbered images are pre-processed while all even numbered images are processed to images. During the second pass, the odds are processed to images while the evens are pre-processed. With this "two pass" procedure, the ASP is able to produce an 8k by 8K pixel image with an end-to-end throughput rate of less than 3 minutes.

The important pre-processing highlights two features: (1) signal measurement, and (2) Doppler measurement, which are performed by a "two dimensional FFT" (2DFFT) algorithm. The 2DFFT operation performs FFT in both the range and azimuth dimensions to obtain the 2DFFT spectra from which the signal to noise ratio and the Doppler centroid are calculated. The ASP pipeline architecture performs the main processing with controls similar to those used with ERS-1 except the control registers are setup for L-band rather than for C-band.

The Committee on Earth Observation Satellites (CEOS) format, encapsulates the ASF products which include the SAR data and the auxiliary information describing the data and the processing. Finally, this paper reviews system performance of the SPS for the SAR image processing of JERS-1 data.